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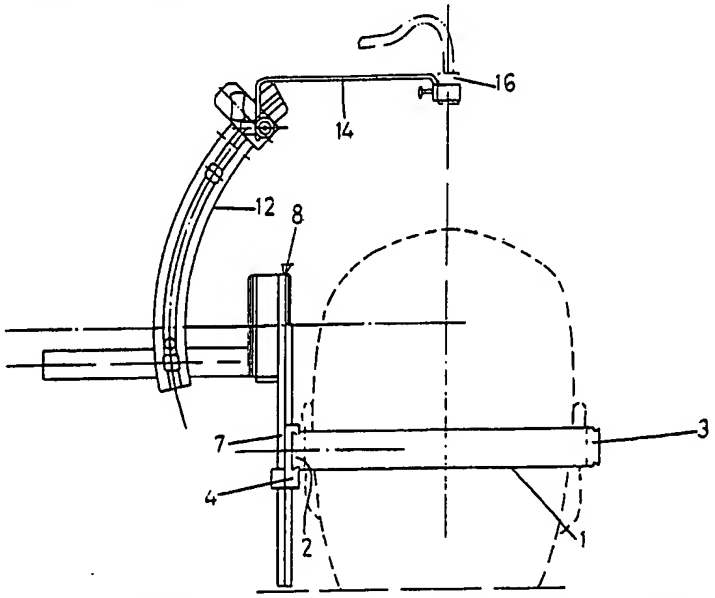

(57) Abstract

The present invention relates to an apparatus for marking the position of a target constituting a portion in a patient's brain, which is to be surgically treated, CT, NMR or X-ray equipment combined with a stereotactic instrument being used for defining the target position. The novel apparatus comprises a frame (1) which in per se known manner is nondisplaceably attachable to the patient's skull and contains at least one guide means (2, 3) extending in a first direction, a member (7) supported by said guide means and slidable in a direction thereof and in a direction perpendicular thereto, said member carrying means (8, 9) allowing rotation in the plane of the first guide means and about an axis perpendicular to the second direction, and a supporting arm (10) connected to said means and extending in parallel with said axis, but eccentrically in relation thereto, a laser light source holder (15) which is connected to said supporting arm by an arcuate member (12), being adjustably mounted relative to said supporting arm.

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APPARATUS FOR MARKING AN OPERATING SITE

The present invention relates to an apparatus for accurately defining to the surgeon, particularly in brain surgery but also in other types of surgery, the target or operating site.

In microsurgery, but also in surgery by scalpel and surgical laser, the surgeon must frequently work more or less on instinct on the basis of known measured values, for example the depth from the skull bone to the tissue portion to be treated and the position of such tissue portion relative to known starting points. Use is also made of a cannula as a sighting aid which is inserted towards the target and makes it easier for the surgeon to reach the target. The known methods must be regarded as unreliable, especially for surgery deep down and when the target, i.e. the tissue portion to be treated, is of small extent. There is thus a risk that the surgeon fails to reach the correct site and/or is forced to perform unnecessary penetration of intervening tissue.

The object of this invention is to provide an apparatus for defining the position of an operating site.

The characteristic features of the apparatus according to the invention are stated in the claims.

The invention is based on the established fact that NMR, CT and/or X-ray equipment makes it possible to define with great accuracy the position also of deep-seated tissue portions in the skull or in some other part of the body. The position can be defined by coordinates by means of a stereotactic instrument attached to the patient's head.

The invention allows the surgeon to be guided by safe and yet uncomplicated assessments of distance and depth, straight at the tissue portion to be treated.

The invention will be described in greater detail

below, reference being had to the accompanying drawing in which Fig. 1 is a front view of the apparatus according to the invention, Fig. 2 is a side view thereof, and Figs. 3-6 illustrate various settings.

It is here assumed that the area to be treated, the target, has been localised by computer tomography, X-ray or NMR technique, whereby highly accurate data as to the location of the target have been obtained. A stereotactic instrument whose design and function are assumed to be known, has been used for determining the target coordinates.

A frame which is designated 1 in the drawing and which is dovetailed along at least two sides 2, 3 to form guide means, is attached to the patient's head in a stable, nondisplaceable position. Along the frame side to the left in the drawing, a cross-table designated 4 is slidable along the frame side 2. The frame sides 2 and 3 are provided with a rule, and the cross-table 4 has corresponding reference marks. The cross-table 4 comprises a guide groove 6 for a rod 7 which is also preferably dovetailed and provided with a rule, and an annular member 8 is mounted at the upper end of the rod. The annular member comprises an outer ring 8' which has a collar and is attached to the rod 7, and an inner ring 8'' having an opposing collar. The cross-table also comprises locking screws for positioning the cross-table 4 relative to the frame side 2, and the rod 7 relative to the cross-table. The rod 7 supports, via the annular member 8, a ring 9 rotatable relative to the annular member, a rule and reference marks, as well as a means for locking the ring to the annular member, being provided as well.

A shaft 10 is mounted on the ring assembly 9, and along said shaft which is dovetailed in cross-section, an arcuate member 12 having a plurality of transverse radial dovetail grooves 11 is slidably mounted. Along the arcuate member 12 which is also dovetailed in cross-

section, a slide 13 is movable. A supporting arm 14 is settably connected with the slide 13, and the outer free end of the supporting arm is provided with a holder 15 for a light source 16 generating an aiming laser beam.

The light source may be a laser light source with a parallel bundle of light, but can also be adapted to generate two or more converging beams which can be set to coincide in a focus defining the operating site or target.

It is also possible to use a specially designed rule 17 for measuring the depth or distance to the target, starting from the light holder 15.

On the basis of the data which have been obtained upon localisation of the target, i.e. the tissue portion to be treated, and which are transferred to the stereotactic instrument, the coordinates are obtained which are required for setting the light source 16, while using the frame 1 as a reference, such that the beam from the light source is directed at the treating site or target.

In surgery where surgical microscopes are used, so-called microsurgery, the surgeon proceeds down to the target along the aiming laser beam and removes tissue by a surgical laser or uses conventional tools such as a scalpel or the like. Since the surgeon can constantly follow the aiming laser beam, the operation is facilitated and the interference with the surrounding tissue is minimised.

The possibility of accurately defining the target defined by the coordinates and the adjustability of the light source with respect to the angle and direction of incidence enable the surgeon to choose the position of and direction for the incision. The setting of the aiming laser beam is carried out in a completely safe manner independently of which direction or angle has been chosen for the incision.

Figs. 3-6 illustrate different settings of the light source, and it is obvious that a variety of settings are possible. The apparatus also allows, when necessary, a different entering angle to be selected during the operation without necessitating resetting. The frame can, of course, be used to position the patient's head relative to the operation table or the like and can also be used as an attachment for surgical instruments, tools or the like.

The invention is not restricted to what has been described above and shown in the drawing, but can be modified in various ways within the scope of the appended claims.

CLAIMS

1. An apparatus for marking the position of a target constituting a portion in a patient's brain, which is to be surgically treated, said target position being determined in advance by means of CT, NMR or X-ray equipment combined with a stereotactic instrument for defining the target position in coordinate planes and coordinate angles, c h a r a c t e r i s e d in that said apparatus comprises a frame (1) which in per se known manner is nondisplaceably attachable to the patient's skull and contains at least one guide means (2, 3) extending in a first direction, a member (7) supported by said guide means and slidable in the direction thereof and in a direction perpendicular thereto, said member carrying means (8, 9) allowing rotation in the plane of the first guide means and about an axis perpendicular to the second direction, and a supporting arm (10) connected to said means and extending in parallel with said axis, but eccentrically in relation thereto, a laser light source holder (15) which is connected to said supporting arm by an arcuate member (12), being adjustably mounted relative to said supporting arm.

2. An apparatus as claimed in claim 1, c h a r a c t e r i s e d in that said first guide means comprises a side piece (2 or 3) of said frame (1) which is nondisplaceably attachable to the patient's skull, said side piece (2 or 3) being dovetailed and supporting a cross-piece (4) which is slidable relative thereto and has two intersecting dovetailed portions, one of which engages with said frame side piece (2 or 3) and the other with a rod (7) extending perpendicular to said frame side piece, a coupling (8, 9) being arranged at the end of said rod and transversely thereof, and allowing rotation, from which coupling an arm (10) projects which is mounted in parallel with said axis of

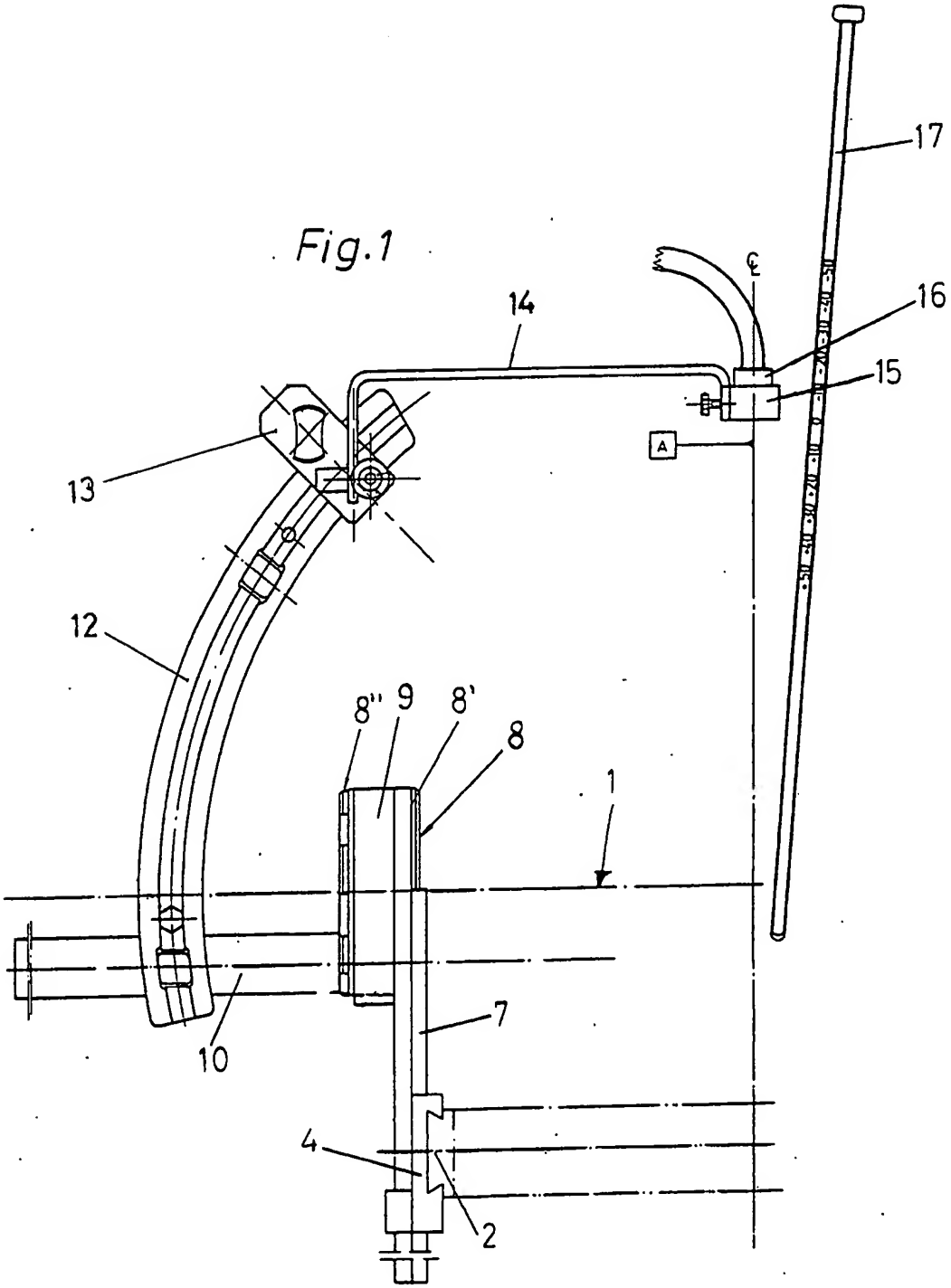
rotation but eccentrically in relation thereto and which, in turn, slidably supports an arcuately curved rod (12) on which an arm (14) holding said light source (16) is adjustably mounted.

3. An apparatus as claimed in claim 1 or 2, c h a r a c t e r i s e d in that said frame (1) non-displaceably attachable to the patient's skull is provided with means for nondisplaceably fixing the frame and, thus, the patient's head to an operating table or like supporting device.

4. An apparatus as claimed in claim 3, c h a r a c t e r i s e d in that said frame (1) is adapted to support surgical instruments, tools or the like.

5. An apparatus as claimed in claim 1 or 2, c h a r a c t e r i s e d in that the distance to the depth of said target can be measured by a rule (17) starting from said holder (15).

Fig.1



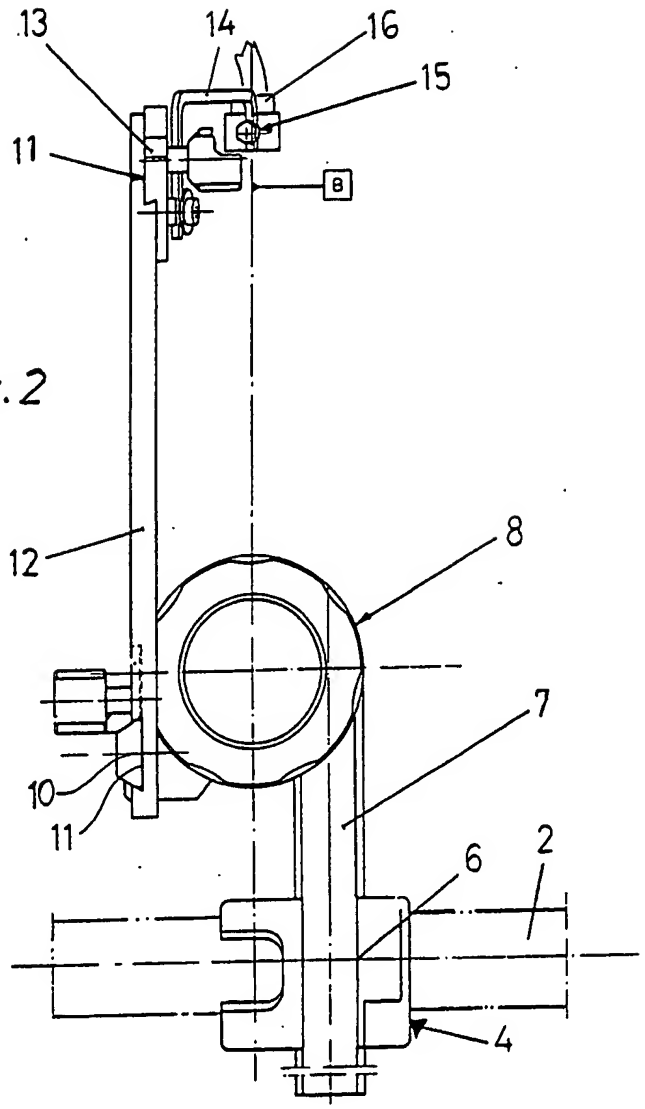


Fig. 2

Fig. 3V

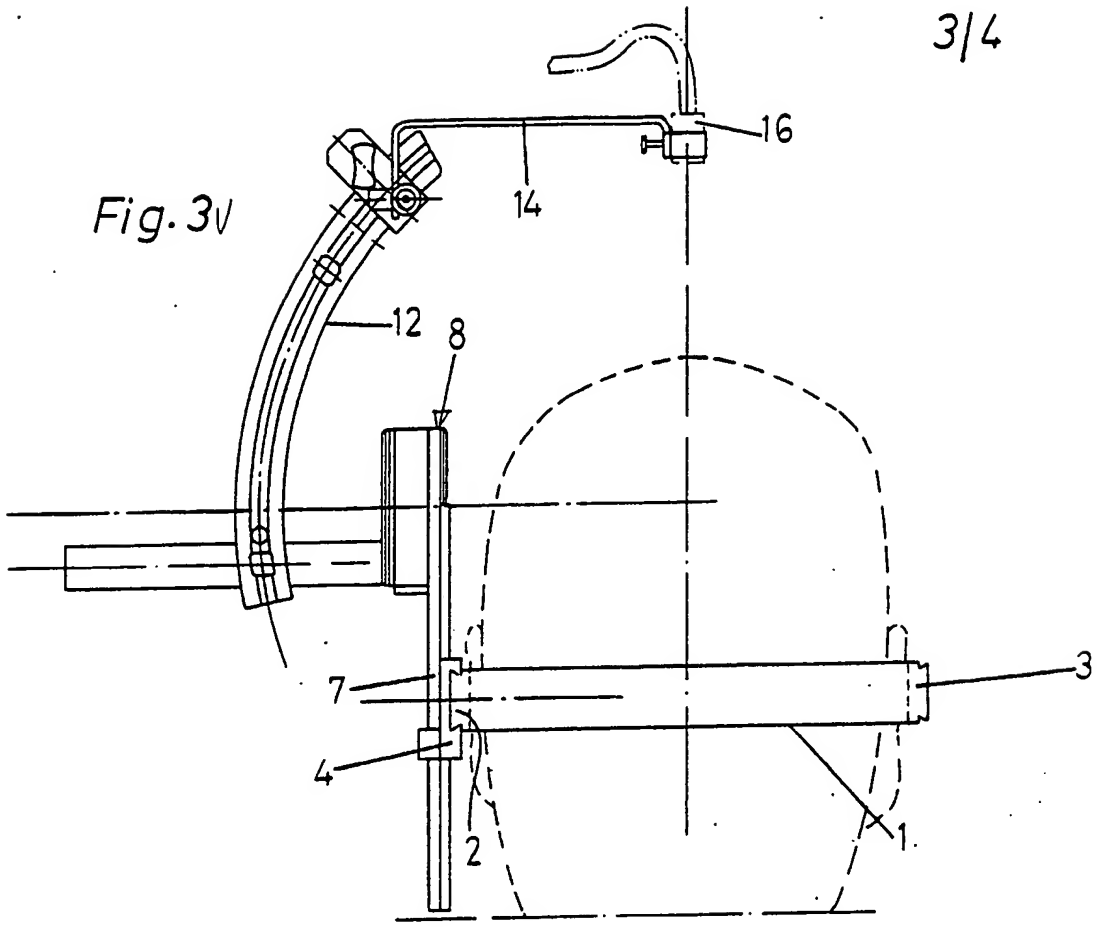


Fig. 4

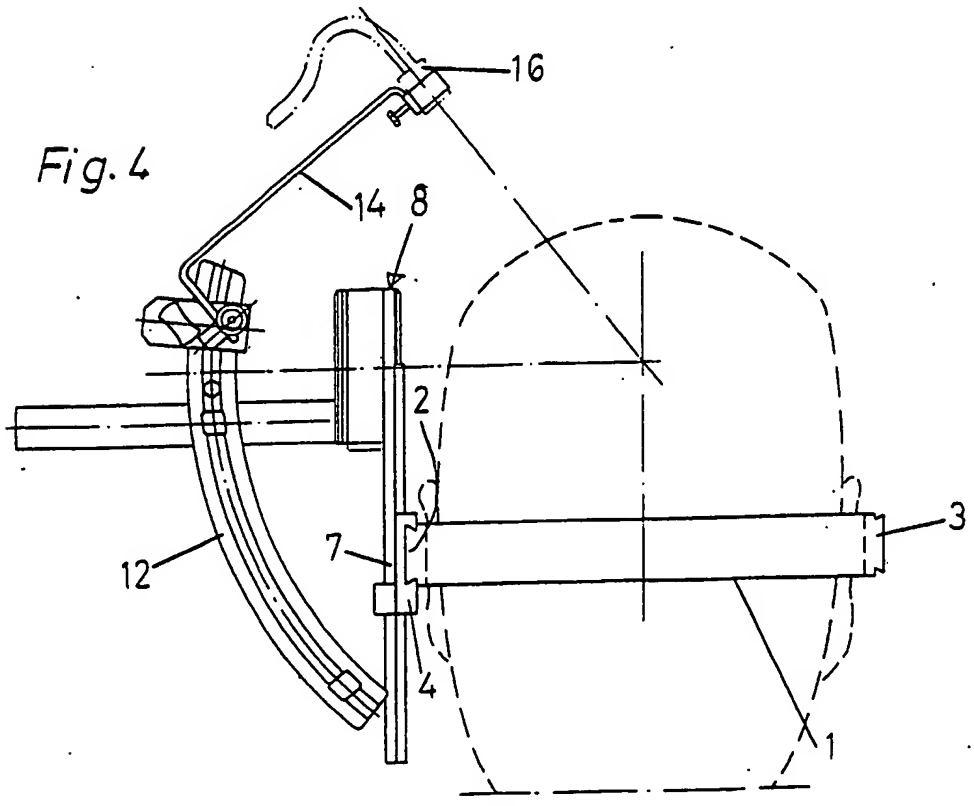


Fig.5

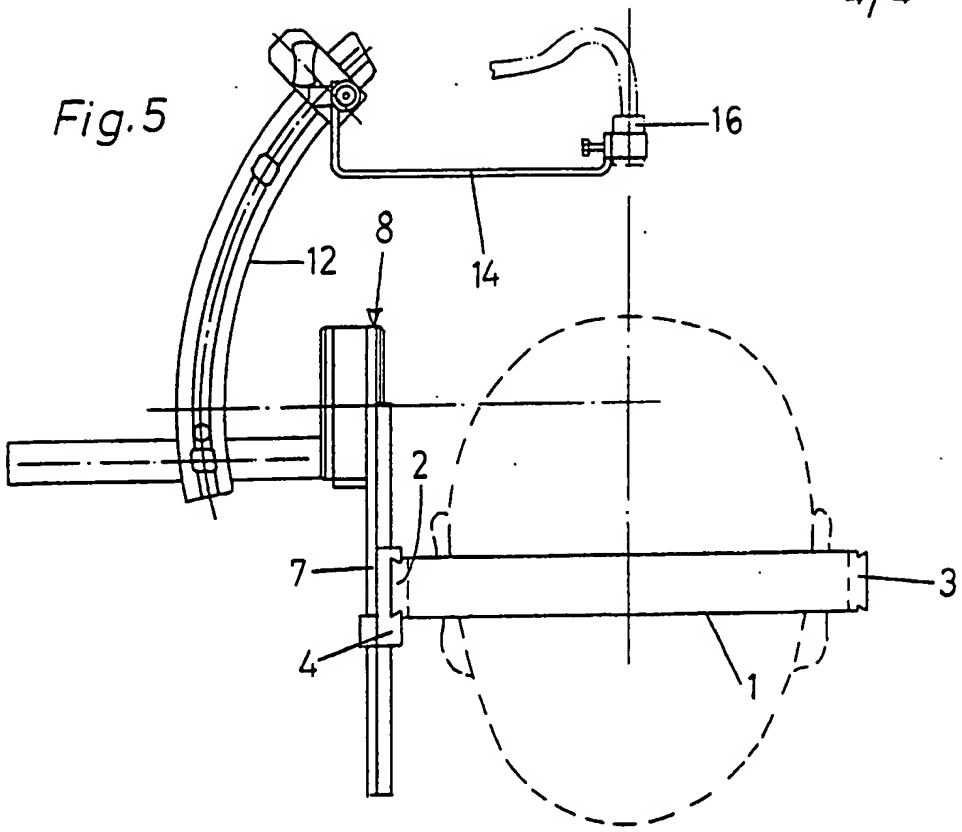
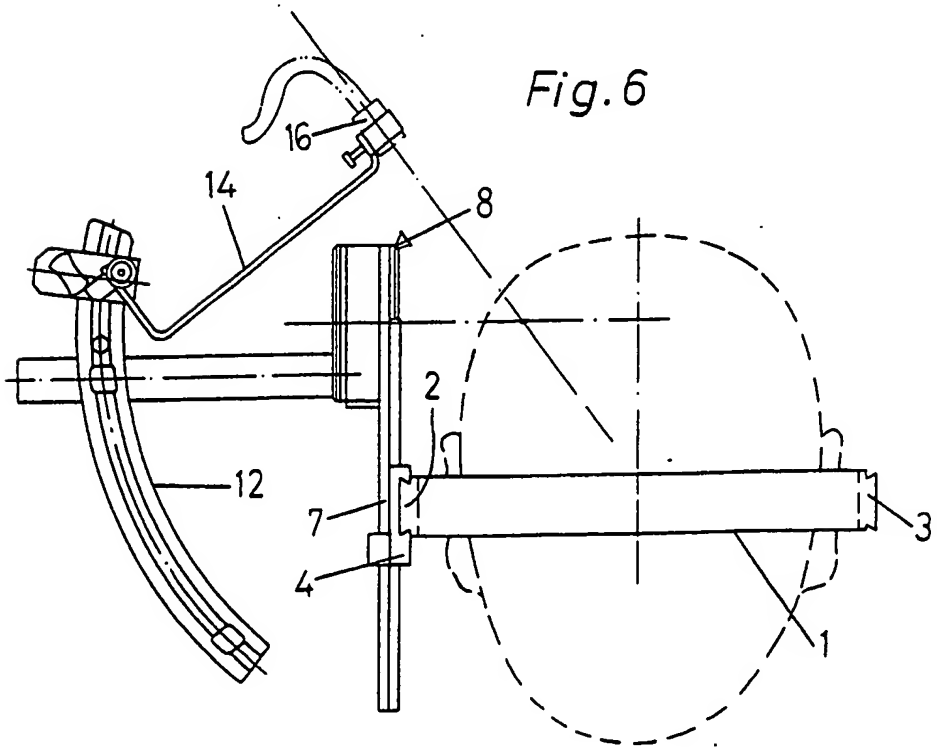


Fig.6



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE88/00214

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

A 61 B 19/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	A 61 B 19/00
US Cl	128: 303, 303.1, 395-397

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 4 651 732 (FREDERICK) 24 March 1987 & JP, 59177031	1-5
Y	US, A, 4 592 352 (PATIL) 3 June 1986	1-5
Y	DE, A, 2 139 433 (SCHMIDT) 15 February 1973	1-5
A	US, A, 4 454 882 (TAKANO) 19 June 1984	
A	US, A, 4 638 801 (DALY et al) 27 January 1987	
A	US, A, 4 215 694 (ISAKOV et al) 5 August 1980	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
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